IN THE CLAIMS

Claims 1 - 39 cancelled.

40. (Original) A process for liquefying a natural gas stream, said process comprising the steps of:

(a) cooling the natural gas stream in a first refrigeration cycle employing a first refrigerant;

(b) cooling the natural gas stream in a second refrigeration cycle employing a second refrigerant;

(c) cooling the natural gas stream in a third refrigeration cycle employing a third refrigerant; and

(d) cooling the natural gas stream in a multi-stage expansion cycle comprising at least 3 expansion stages, said multi-stage expansion cycle comprising 2 or fewer phase separators.

41. (Original) A process according to claim 40,

said third refrigerant comprising predominantly methane.

42. (Original) A process according to claim 41,

said first refrigerant comprising predominantly propane, propylene, or mixtures thereof,

said second refrigerant comprising predominantly ethane, ethylene, or mixtures thereof.

43. (Original) A process according to claim 42,

step (b) being performed downstream of step (a),

step (c) being performed downstream of step (b),

step (d) being performed downstream of step (c).

44. (Original) A process according to claim 40,

said process for liquefying a natural gas stream being a cascade-type refrigeration process.

45. (Original) A process according to claim 40,

said third refrigeration cycle being an open methane refrigeration cycle.

46. (Original) A process according to claim 40,

said third refrigeration cycle comprising a methane economizer comprising a plurality of heat exchanger passes for providing indirect heat exchange between a plurality of predominantly methane streams,

step (c) including cooling the natural gas stream in a first heat exchanger pass of the methane economizer.

47. (Original) A process according to claim 46,

step (d) including the substeps of:

(d1) reducing the pressure of at least a portion of the natural gas stream in a first expander to thereby provide a first pressure-reduced stream;

(d2) separating at least a portion of the first pressure-reduced stream into a first separated stream and a second separated stream;

(d3) warming at least a portion of the first separated stream in a second heat exchanger pass of the methane economizer to thereby provide a first warmed stream; and

(d4) cooling at least a portion of the second separated stream in a third heat exchanger pass of the methane economizer to thereby provide a second cooled stream.

48. (Original) A process according to claim 47,

substep (d1) including flashing the natural gas stream,

substep (d2) including phase separating the first pressure-reduced stream,

said first separated stream comprising primarily vapor,

said second separated stream comprising primarily liquid.

49. (Original) A process according to claim 47,

said first pressure-reduced stream, said first separated stream, and said second separated stream each comprising less than about 5 mole percent vapor.

50. (Original) A process according to claim 47; and

(e) compressing at least a portion of the first warmed stream in a compressor.

51. (Original) A process according to claim 47,

step (d) including the substeps of:

(d5) reducing the pressure of at least a portion of the second cooled stream in a second expander to thereby provide a second pressure-reduced stream;

(d6) separating at least a portion of the second pressure-reduced stream into a third separated stream and a fourth separated stream;

(d7) warming at least a portion of the third separated stream in a fourth heat exchanger pass of the methane economizer to thereby provide a second warmed stream; and

(d8) cooling at least a portion of the fourth separated stream in a fifth heat

exchanger pass of the methane economizer to thereby provide a third cooled stream.

52. (Original) A process according to claim 51,

said second pressure-reduced stream, said third separated stream, and said fourth separated stream comprising less than about 5 mole percent vapor.

53. (Original) A process according to claim 51; and

(f) compressing at least a portion of the second warmed stream in a compressor.

54. (Original) A process according to claim 51,

step (d) including the substeps of:

(d9) reducing the pressure of at least a portion of the third cooled stream to thereby provide a third pressure-reduced stream;

(d10) separating at least a portion of the third pressure-reduced stream into a fifth separated stream and a sixth separated stream;

(d11) conducting at least a portion of the fifth separated stream to a liquefied natural gas storage tank; and

(d12) warming at least a portion of the sixth separated stream in a sixth heat exchanger path of the methane economizer to thereby provide a third warmed stream.

55. (Original) A process according to claim 54,

said third pressure-reduced stream, said fifth separated stream, and said sixth separated stream comprising less than about 5 mole percent vapor.

56. (Original) A process according to claim 54,

step (d) including the substep of:

(d13) warming at least a portion of the third warmed stream in a seventh heat exchanger pass of the methane economizer to thereby provide a fourth warmed stream.

57. (Original) A process according to claim 56; and

(g) compressing at least a portion of the fourth warmed stream in a compressor.

58. (Original) A process according to claim 56; and

(h) combining a boil-off vapor stream from the liquefied natural gas storage tank with at least a portion of the third warmed stream,

step (d13) including warming the combined third warmed stream and boil-off vapor stream in the seventh heat exchanger pass of the methane economizer to thereby provide the fourth warmed stream.

59. (Original) A process according to claim 40; and

(i) vaporizing liquefied natural gas produced via steps (a) - (d).

60. (Original) A process for liquefying a natural gas stream, said process comprising the steps of:

(a) cooling the natural gas stream via indirect heat exchange with a first predominantly methane stream or group of streams to thereby provide a first cooled stream;

(b) separating at least a portion of the first cooled stream into a first separated stream and a second separated stream;

(c) compressing at least a portion of the first separated stream in a compressor; and

(d) cooling at least a portion of the second separated stream via indirect heat exchange with a second predominantly methane stream or groups of streams to thereby form a second cooled stream.

61. (Original) A process according to claim 60; and

(e) prior to step (a), cooling at least a portion of the natural gas stream via indirect heat exchange with a predominantly propane or propylene stream.

62. (Original) A process according to claim 61; and

(f) prior to step (a) but subsequent to step (e), cooling at least a portion of the natural gas stream via indirect heat exchange with a predominantly ethane or ethylene stream.

63. (Original) A process according to claim 60,

said process for liquefying a natural gas stream being a cascade-type refrigeration process.

64. (Original) A process according to claim 60,

step (a) being carried out as part of an open methane refrigeration cycle.

65. (Original) A process according to claim 60,

said first and second predominantly methane streams or groups of streams comprising the same stream or group of streams.

66. (Original) A process according to claim 60,

step (b) including phase separating the first cooled stream,

said first separated stream comprising primarily vapor,

said second separated stream comprising primarily liquid.

67. (Original) A process according to claim 60,

step (b) including splitting the first cooled stream into the first and second separated streams with substantially no phase separation,

said first and second separated streams comprising less than about 5 mole percent vapor.

68. (Original) A process according to claim 60; and

(g) prior to step (c), warming at least a portion of the first separated stream via indirect heat exchange with a third predominantly methane stream or groups of streams to thereby provide a first warmed stream.

69. (Original) A process according to claim 60; and

(h) prior to step (b), reducing the pressure of at least a portion of the first cooled stream in a first expander to thereby provide a first pressure-reduced stream,
step (b) including separating at least a portion of the first pressure-reduced stream into the first separated stream and the second separated stream.

70. (Original) A process according to claim 69,

step (h) including flashing the first cooled stream.

71. (Original) A process according to claim 69,

step (h) involving substantially no flashing of the first cooled stream.

72. (Original) A process according to claim 60; and

(i) reducing the pressure of at least a portion of the second cooled stream in a second expander to thereby provide a second pressure-reduced stream; and

(j) splitting at least a portion of the second pressure-reduced stream into a first split stream and a second split stream.

73. (Original) A process according to claim 72,

said second pressure-reduced stream, said first split stream, and said second split stream each comprising less than about 5 mole percent vapor.

74. (Original) A process according to claim 72; and

(k) cooling at least a portion of the second split stream via indirect heat exchange to thereby provide a third cooled stream.

75. (Original) A process according to claim 74; and

(l) warming at least a portion of the first split stream via indirect heat exchange to thereby provide a second warmed stream; and

(m) compressing at least a portion of the second warmed stream in the compressor.

76. (Original) A process according to claim 74; and

(n) reducing the pressure of at least a portion of the third cooled stream in a third expander to thereby provide a third pressure-reduced stream; and

(o) splitting at least a portion of the third pressure-reduced stream into a third split stream and a fourth split stream,

said third pressure-reduced stream, said third split stream, and said fourth split

stream each comprising less than about 5 mole percent vapor.

77. (Original) A process according to claim 76; and

(p) warming at least a portion of the fourth split stream via indirect heat exchange to thereby provide a third warmed stream.

78. (Original) A process according to claim 77; and

(q) conducting at least a portion of the third split stream to a liquefied natural gas storage tank.

79. (Original) A process according to claim 78; and

(r) combining at least a portion of the third warmed stream with a boil-off vapor stream from the liquefied natural gas storage tank to thereby form a combined stream.

80. (Original) A process according to claim 79; and

(s) warming at least a portion of the combined stream by indirect heat exchange to thereby form a fourth warmed stream; and

(t) compressing at least a portion of the fourth warmed stream in the compressor.

81. (Original) A process according to claim 60; and

(u) vaporizing liquefied natural gas produced via steps (a) - (d).

82. (Original) A process for liquefying a natural gas stream, said process comprising the steps of:

(a) reducing the pressure of the natural gas stream to thereby provide a

first pressure-reduced stream comprising less than about 5 mole percent vapor;

(b) splitting at least a portion of the first pressure-reduced stream into a first split stream and a second split stream, each of said first and second split streams comprising less than about 5 mole percent vapor;

(c) conducting at least a portion of the first split stream to a liquefied natural gas storage tank; and

(d) heating at least a portion of the second split stream by indirect heat exchange with a first predominantly methane stream to thereby provide a first warmed stream.

83. (Original) A process according to claim 82; and

(e) prior to step (a), cooling at least a portion of the natural gas stream via indirect heat exchange with a second predominantly methane stream.

84. (Original) A process according to claim 83; and

(f) prior to step (e), cooling at least as portion of the natural gas stream via indirect heat exchange with a predominantly propane or propylene stream.

85. (Original) A process according to claim 84; and

(g) prior to step (e), cooling at least a portion of the natural gas stream via indirect heat exchange with a predominantly ethane or ethylene stream.

86. (Original) A process according to claim 82,

said process for liquefying a natural gas stream being a cascade-type refrigeration process.

87. (Original) A process according to claim 82,

step (a) being carried out as part of a multi-stage expansion cooling cycle.

88. (Original) A process according to claim 82,

step (a) involving substantially no flashing of the natural gas stream.

89. (Original) A process according to claim 82; and

(h) combining at least a portion of the first warmed stream with boil-off vapors from the liquefied natural gas storage tank to thereby form a combined stream.

90. (Original) A process according to claim 89; and

(i) compressing at least a portion of the combined stream in a compressor.

91. (Original) A process according to claim 90; and

(j) prior to step (i), warming at least a portion of the combined stream by indirect heat exchange.

92. (Original) A process according to claim 82; and

(k) prior to step (a), reducing the pressure of at least a portion of the natural gas stream to thereby provide a second pressure-reduced stream;

(l) prior to step (a), splitting at least a portion of the second pressure-reduced stream into a third split stream and a fourth split stream; and

(m) prior to step (a), cooling at least a portion of the fourth split stream by indirect heat exchange to thereby provide a first cooled stream,

step (a) including reducing the pressure of at least a portion of the first cooled stream.

93. (Original) A process according to claim 92; and

(n) compressing at least a portion of the third split stream in a compressor.

94. (Original) A process according to claim 93; and

(o) prior to step (n), warming at least a portion of the third split stream by indirect heat exchange.

95. (Original) A process according to claim 92,

step (k) involving substantially no flashing of the natural gas stream.

96. (Original) A process according to claim 92,

said second pressure-reduced stream, said third split stream, and said fourth split stream comprising less than about 5 mole percent vapor.

97. (Original) A process according to claim 92; and

(p) prior to step (k), cooling at least a portion of the natural gas stream via indirect heat exchange with a second predominantly methane stream.

98. (Original) A process according to claim 92; and

(q) prior to step (k), reducing the pressure of at least a portion of the natural gas stream to thereby provide a third pressure-reduced stream;

(r) prior to step (k), separating at least a portion of the third pressure-reduced stream into a first separated stream and a second separated stream; and

(s) prior to step (k), cooling at least a portion of the second separated stream by indirect heat exchange to thereby provide a second cooled stream,

step (k) including reducing the pressure of at least a portion of the second

cooled stream.

99. (Original) A process according to claim 98; and

(t) compressing at least a portion of the first separated stream in a compressor.

100. (Original) A process according to claim 99; and

(u) prior to step (t), warming at least a portion of the first separated stream by indirect heat exchange.

101. (Original) A process according to claim 98,

step (q) including flashing the natural gas stream.

102. (Original) A process according to claim 101,

step (r) including phase separating the third pressure-reduced stream, said first separated stream comprising primarily vapor,

said second separate stream comprising primarily liquid.

103. (Original) A process according to claim 98,

step (q) involving substantially no flashing of the natural gas stream.

104. (Original) A process according to claim 98,

said third pressure-reduced stream, said first separated stream, and said second separated stream each comprising less than about 5 mole percent vapor.

105. (Original) A process according to claim 98; and

(v) prior to step (q), cooling at least a portion of the natural gas stream via indirect heat exchange with a third predominantly methane stream.

106. (Original) A process according to claim 82; and

(w) vaporizing liquefied natural gas produced via steps (a) - (d).

107. (Original) An apparatus for liquefying a natural gas stream, said apparatus comprising:

a methane economizer for providing indirect heat exchange between a plurality of predominantly methane streams via a plurality of heat exchanger passes, said methane economizer comprising a first heat exchanger pass for cooling at least a portion of the natural gas stream; and

a multi-stage methane expansion cycle for receiving at least a portion of the cooled natural gas stream from the first heat exchanger pass, said methane expansion cycle comprising at least 3 expanders for sequentially reducing the pressure of the natural gas stream, said methane expansion cycle comprising 2 or less phase separators.

108. (Original) An apparatus according to claim 107; and

a first refrigeration cycle employing a predominantly propane or propylene refrigerant to cool the natural gas stream.

109. (Original) An apparatus according to claim 108; and

a second refrigeration cycle employing a predominantly ethane or ethylene refrigerant to cool the natural gas stream,

said second refrigeration cycle being disposed downstream of the first refrigeration cycle and upstream of the methane economizer.

110. (Original) An apparatus according to claim 107,

said methane economizer and said methane expansion cycle being part of an open methane refrigeration cycle.

111. (Original) An apparatus according to claim 107,

said methane expansion cycle comprising a first expander for reducing the pressure of the natural gas stream received from the first heat exchanger pass,

said methane expansion cycle comprising a separator for separating the pressure-reduced natural gas stream received from the first expander into a first separated stream and a second separated stream,

said methane economizer comprising a second heat exchanger pass for warming the first separated stream received from the separator,

said methane economizer comprising a third heat exchanger pass for cooling the second separated stream received from the separator.

112. (Original) An apparatus according to claim 111,

said separator being a phase separator operable to separate liquid and vapor phases of the natural gas stream.

113. (Original) An apparatus according to claim 111,

said separator being a splitter for splitting the natural gas stream into multiple streams without significant phase separation.

114. (Original) An apparatus according to claim 111; and

a compressor for compressing the warmed first separated stream received from the second heat exchanger pass.

115. (Original) An apparatus according to claim 111,

said methane expansion cycle comprising a second expander for reducing the pressure of the cooled second separated stream received from the third heat exchanger pass,

said methane expansion cycle comprising a first splitter for splitting the pressure-reduced second stream received from the second expander into a first split stream and a second split without substantial phase separation,

said methane economizer comprising a fourth heat exchanger pass for warming the first split stream received from the first splitter,

said methane economizer comprising a fifth heat exchanger pass for cooling the second split stream received from the first splitter.

116. (Original) An apparatus according to claim 115; and

a multi-stage compressor for compressing the warmed first separated stream received from the second heat exchanger pass and the warmed first split stream received from the fourth heat exchanger pass.

117. (Original) An apparatus according to claim 115,

said methane expansion cycle comprising a third expander for reducing the pressure of the cooled second split stream from the fifth heat exchanger pass,

said methane expansion cycle comprising a second splitter for splitting the pressure-reduced second split stream received from the third expander into a third split stream and a fourth split stream,

said methane economizer comprising a sixth heat exchanger pass for warming the fourth split stream received from the second splitter.

118. (Original) An apparatus according to claim 117; and

a liquefied natural gas storage tank for storing the third split stream received from the second splitter.

119. (Original) An apparatus according to claim 118; and

a tee for combining boil-off vapors received from the liquefied natural gas storage tank and the warmed fourth split stream received from the sixth heat exchanger pass.

120. (Original) An apparatus according to claim 119,

said methane economizer comprising a seventh heat exchanger pass for warming the combined stream received from the tee.

121. (Original) An apparatus according to claim 120; and

a multi-stage compressor for compressing the warmed first separated stream received from the second heat exchanger pass, the warmed first split stream received from the fourth heat exchanger pass, and the warmed combined stream received from the seventh heat exchanger pass.

122. (Original) A liquefied natural gas product produced via the process of claim 1.

123. (Original) A liquefied natural gas product produced via the process of claim 16.

124. (Original) A liquefied natural gas product produced via the process of claim 23.

125. (Original) A liquefied natural gas product produced via the process of claim 40.

126. (Original) A liquefied natural gas product produced via the process of claim 60.

127. (Original) A liquefied natural gas product produced via the process of claim 82.

128. (Original) A computer simulation process comprising using a computer to simulate the process of claim 1.

129. (Original) A computer simulated process comprising using a computer to simulate the process of claim 16.

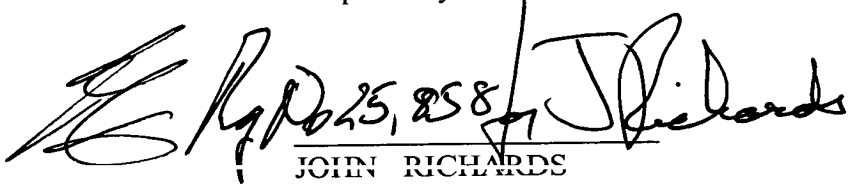
130. (Original) A computer simulation process comprising using a computer to simulate the process of claim 23.

131. (Original) A computer simulation process comprising using a computer to simulate the process of claim 40.

132. (Original) A computer simulation process comprising using a computer to simulate the process of claim 60.

133. (Original) A computer simulation process comprising using a computer to simulate the process of claim 82.

Respectfully submitted,



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